

Sept. 17, 1968

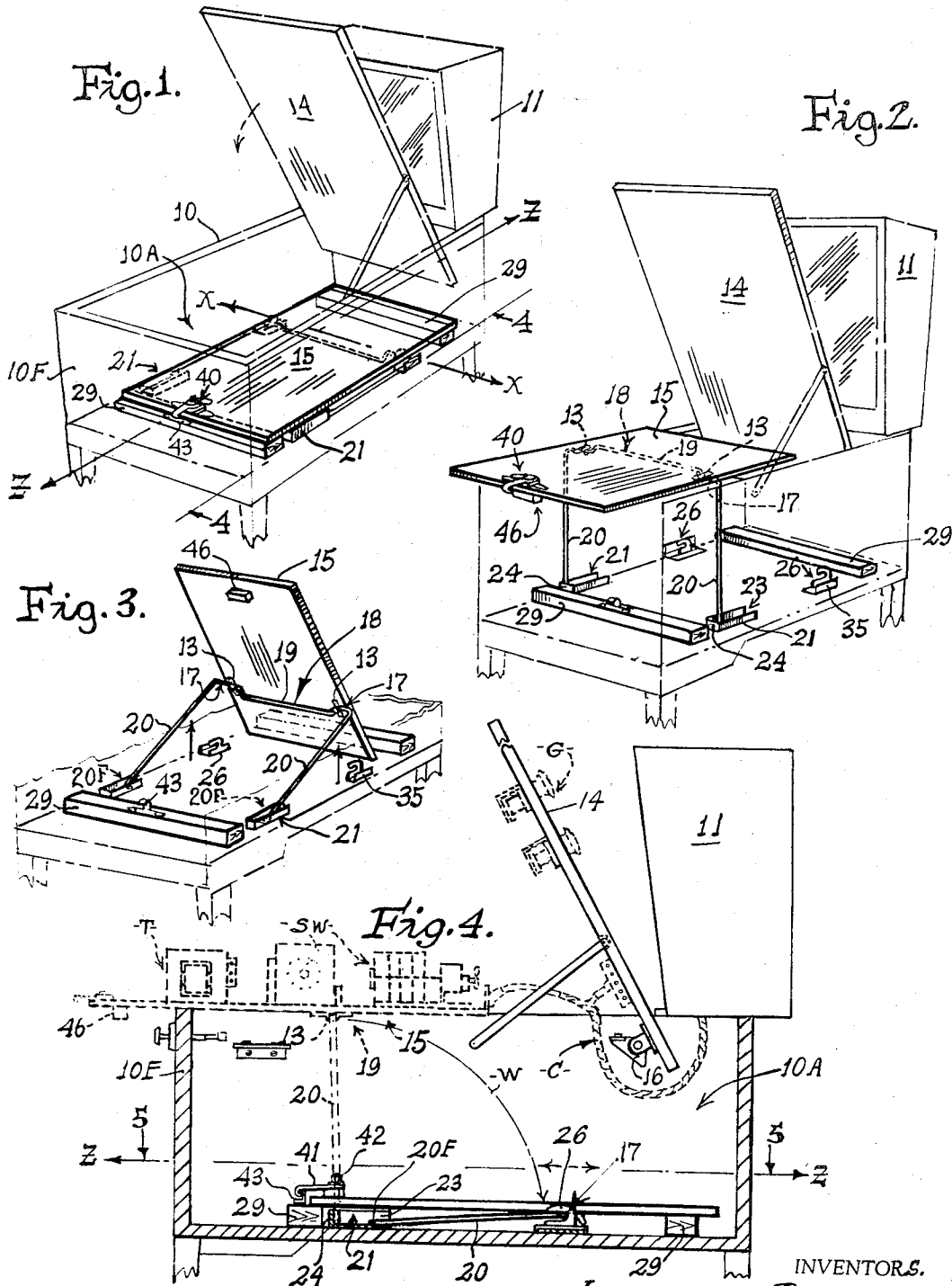
L. P. BENSON ET AL

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SUBPANEL ELEVATING MEANS FOR APPARATUS CABINETS

Filed March 18, 1966

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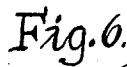
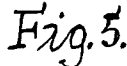
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SUBPANEL ELEVATING MEANS FOR APPARATUS CABINETS

3 Sheets-Sheet 2



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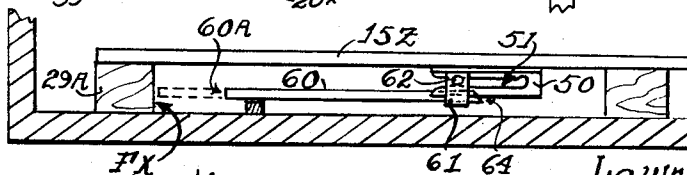
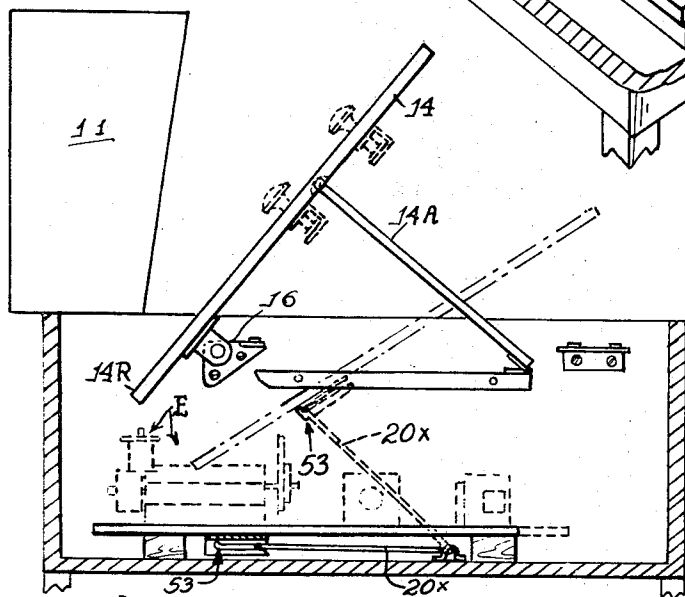
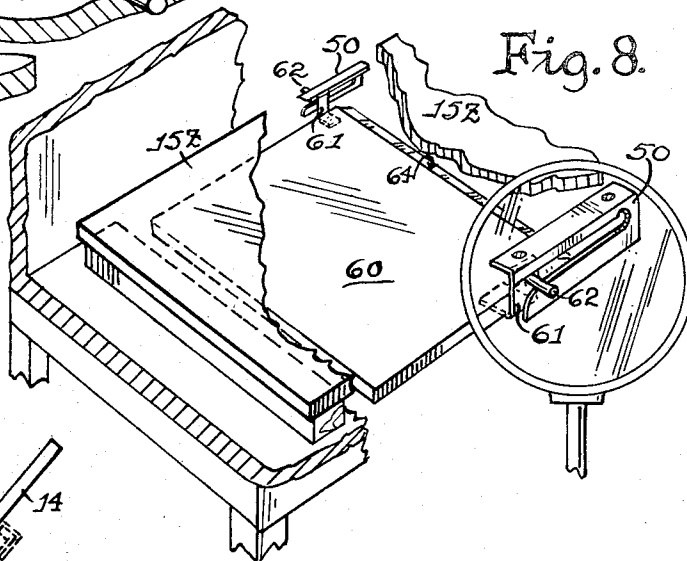
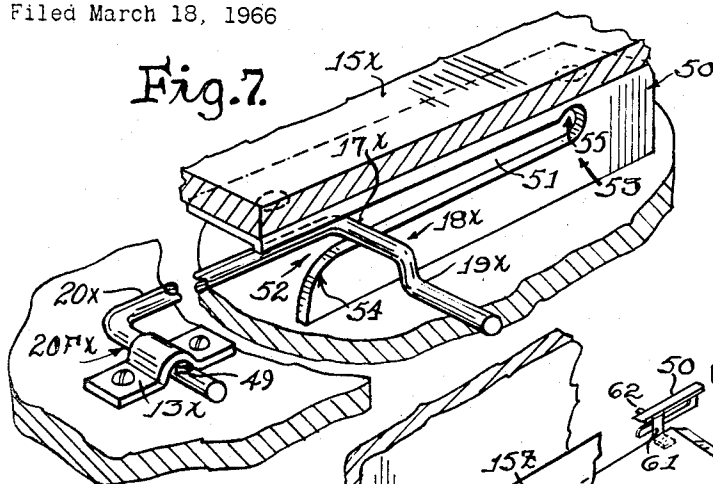
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SUBPANEL ELEVATING MEANS FOR APPARATUS CABINETS

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3 Sheets-Sheet 3



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3,401,992

SUBPANEL ELEVATING MEANS FOR APPARATUS CABINETS

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Filed Mar. 18, 1966, Ser. No. 535,605
18 Claims. (Cl. 312—27)

ABSTRACT OF THE DISCLOSURE

A lever system for pivotally swinging a stowed device upwardly out of a compartment or the like for support partly by a member of the lever system and partly on a part of the compartment, wherein the lever member is first brought into engagement with a fulcrum abutment by approximately linear translation of the device and a thrust part of the lever member to transform the motion into pivotal upward swinging movement. Supplements to the subject: hold-down and permanent latching means are disclosed for partially or totally securing the device in its lowered stowed condition.

The subpanel elevating means which comprises the subject of this invention has for its primary purpose the guidance, with leverage assistance, of the manually-effected movement of an apparatus panel upwardly and outwardly from the bottom of an apparatus cabinet along a predetermined path until it rests wholly exposed and supported partly upon the edge of one of the cabinet walls and partly by the elevating means, so that apparatus and equipment carried by the subpanel will be easily accessible for purposes of inspection, repair and the like.

While the disclosed subpanel elevating means is of more general application, it is particularly useful in conjunction with the apparatus cabinets such as are used to house amusement apparatus including ball-rolling games which commonly employ a horizontally-disposed cabinet having a removable top panel which may also carry various forms of equipment and which in its normal position closes the cabinet top over another panel, called also the subpanel, disposed therebelow and usually resting on the bottom of the cabinet.

Various kinds of equipment of considerable weight, such as electrical transformers, switching units, relays and the like, are commonly assembled on these subpanels and rest at such a distance below the top opening of the cabinet as to be difficult or impossible to reach and the usual practice is to lift the entire subpanel out of the cabinet and set it across the edges of the cavity where the equipment can be worked upon. Such manipulation is laborious and frequently dangerous to personnel as well as the equipment.

In accordance with the present improvements, the disclosed elevating means makes it unnecessary to lift the dead weight of the panel, and converts the manual lifting effort of the attendant into guided movements causing the panel to follow a certain pattern of motion and rise from the cabinet bottom and move forwardly into a fully exposed and accessible position of rest partly supported by one of the cabinet walls and partly by the elevating means, as will more fully appear.

Among some of the more detailed objects and features of the improvements are: the provision of hold-down cleat means engaged by the elevating means in the lowered position of the subpanel to aid in securing the latter against dislodgement; the provision of a latching means located relative to the hold-down cleat means to render the subpanel wholly immovable for purposes of security

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in handling and shipment; the provision of an elevating and leverage device of simple and inexpensive character which may take the form of a bail pivotally attached to the subpanel and having exposed portions for cleating; legs constituting radius and lever arms provided with terminal portions remote from the pivotal axis thereof which are guided in gliding motion into engagement with a stop means as the result of the removal effort manually applied to the subpanel, and acting in a manner such that the initial motion of the subpanel disengages it from a hold-down cleating means and then converts the motion into an upward and forward translation of the entire panel along a path calculated to carry it wholly out of the well of the cabinet and forwardly thereof to a stable position of rest and access.

In some of its more detailed aspects, the subpanel elevating means embodies a single, load-carrying radius leg structure, which may take the forms of a bail or a solid panel or the like; one radial end region of the leg structure will be engaged with a pivotal attachment means carried either on the subpanel or the cabinet bottom, while the opposite radial end region thereof will be relatively free to shift into a pivotal abutment with a relatively fixed abutment means which is located conversely on the cabinet bottom or the subpanel, the attachment means also permitting a limited amount of linear shifting of the subpanel as a concomitant of the angular exiting and reentry motion thereof, particularly at the beginning of exit movement or termination of reentry movement, such linear motion being also utilized in connection with a latching and hold-down means for preventing unintended shifting of the subpanel in its lowered condition of rest.

Additional objects and aspects of novelty and utility relate to details of the construction and operation of one commercial embodiment of the device described in view of the annexed drawings, in which:

FIGURE 1 is a perspective of a cabinet structure and apparatus subpanel seated therein from which the apparatus is omitted for purposes of clarifying the views;

FIGURE 2 is a view similar to that of FIGURE 1 but showing the subpanel elevated;

FIGURE 3 is a fragmentized view of the cabinet and parts seen in FIGURE 1 and showing the subpanel in the initial (or terminal) phase of its withdrawal (or reentry) movement;

FIGURE 4 is an enlarged cross-sectional view through the cabinet, looking in the direction of lines 4—4 of FIGURE 1, with the subpanel shown seated in full lines and elevated in dotted lines, certain apparatus (which would normally be seen also in FIGURES 1, 2 and 3) being indicated in dotted lines to illustrate the load-bearing function of the subpanel;

FIGURE 5 is a sectional view through the main cabinet compartment taken along lines 5—5 of FIGURE 4 showing the subpanel seated on the cabinet bottom but omitting the apparatus load indicated by dotted lines in FIGURE 4;

FIGURE 6 is a magnified fragmentary perspective detail of cooperative parts of the elevating lever means, hold-down cleat means, and fulcrum shoe;

FIGURE 7 is an enlarged perspective fragment of a modified form of the type of bail lever mechanism shown in FIGURES 1 to 6;

FIGURE 8 is a cut-away fragmentary perspective detail of a cabinet employing a modified form of panel elevating means;

FIGURE 9 is a partial sectional view through a cabinet illustrating the operation of the modification of FIGURE 7;

FIGURE 10 is a fragmentary longitudinal sectional view through the cabinet structure and subpanel shown in the modification of FIGURE 8.

The form of the subpanel elevating means chosen for purposes of illustration is shown in conjunction with a ball-rolling game such as depicted in FIGURE 1 which includes a horizontally-disposed main cabinet section 10 of a type commonly supported on legs and having attached to a rearward portion an upstanding backbox or scoring cabinet 11 which will usually contain some form of electrically-actuated score-display mechanism (not shown) operatively connected by plug-in cables C (dotted lines, FIGURE 4 only) with various forms of cooperative apparatus contained within the well or cavity 10A of the main cabinet section. The cabinet will also commonly include a top panel 14 affording a ball-rolling or like playfield normally lowered and closing off the top of the cabinet and carrying various game components G (dotted lines, FIGURE 4 only) on its upper surface and with portions thereof also disposed on its underside, all in a manner widely known in the art.

Still further cooperative apparatus, for example, which is usually heavy electrical equipment such as a Transformer T, Rotary Switching Devices SW, and the like, as shown in dotted lines in FIGURE 4 only, will be commonly be assembled on a subpanel 15 adapted to rest at the bottom of the main cabinet section, and will lie at a depth below the margin of the opening which makes it difficult to examine and repair such apparatus and laborious and frequently dangerous to lift the panel out bodily to some more accessible position.

The disclosed improvements overcome the problem of subpanel removal and access very effectively by the provision of an elevating lever means in the preferred form of a simple bail-shaped lever means consisting (FIGURE 3—see also FIGURE 6) of a length of metal rod formed into a U-shaped bail having a cross bar or bight 18 which is pivotally attached, as by cleats 13, to the underside of the subpanel at a point between its ends. Cleating portions 17 of the bight 18 are caused to extend somewhat beyond the opposite side margins of the subpanel where they will be free to slide into and out of engagement with certain hold-down cleat means to be described.

Another medial portion of the bight 18 is offset to provide a stop formation 19 which will be turned into engagement against the underside of the subpanel when the latter is lifted and pulled in the initial phase of the elevating translation to be described.

The opposite legs 20 of the elevator bail constitute parallel radial levers which come into action when the angled free end portions or feet 20F thereof have shifted forwardly far enough to thrust against a stopping means affording a fulcrum for lever action of said legs with a consequent conversion of said initial forward lifting motion of the subpanel to an upwardly arcuate swing on a relatively long radius (e.g. equal to the length of the legs 20).

Thus, the elevating displacement of the subpanel occurs in two merging phases, the first being a very short approximately linear forward movement of a few inches having a slight upward component sufficient to permit withdrawal of the sideways hold-down bail projections 17 from the hold-down cleats 26, this initial phase being terminated upon engagement of the feet 20F with the limiting stop walls of a pair of shoes 21, by which time the subpanel will have a certain amount of momentum, and the manual effort will take on more of an upward lifting component having the effect, simultaneously with said forward unlatching motion in the initial phase, of pivoting the subpanel on the bight portion 18 slightly until the offset stop 19 strikes the panel, in consequence of which the motion then becomes mainly the long-radius upward swing alluded to and which is calculated to direct the front end of the subpanel upwardly and out of the open top of the cabinet and beyond the front wall somewhat, while the rearward portions of the panel swing up to the same

level at which they will be supported by the bail, as in FIGURES 3 and 4.

The fulcrum-forming stop and guide means may take the form of a pair of channel-shaped metal shoes 21 (FIGURE 6) each fixed in the bottom of the cabinet as by screws 22 respectively in positions of alignment with one of the feet or offsets 20F of the elevator bail legs, each said shoe having an open front portion 23 and a rear stop wall 24 against which the foot of the appertaining radius leg 20 will be thrust as a result of the initial gliding advance thereof when the subpanel is disengaging the hold-down means. The width of the channel portions of the shoes is slightly greater than the length of the offset foot portions 20F so as to confine the gliding movement of the latter to a predetermined path between flanges 25.

An important aspect of the construction and operation of the foregoing guiding and stopping means 21 is the fact that it does not positively attach the subpanel to the cabinet but leaves it freely separable therefrom in order that it may be taken away without disconnection of anything beyond whatever electrical cables may extend to the backbox, it being frequently necessary to exchange panels or move them elsewhere.

As viewed in FIGURE 6 the hold-down cleats 26 may take the form of angular metal stampings having a vertical web in which the horizontally-extensive open-ended slots 27 are formed, and a base or footing portion 26B pierced to take the screws 28. Another angular stamping 34 constituting a guard member is associated with each said cleat and has a similar portion 34B fitting beneath the base of the hold-down cleat with screw holes registering with those in the cleat so as to be fixed in position by the same cleat screws 28. The guard stampings each have an upstanding flange 35 spaced outwardly from the cleat slots a distance slightly greater (FIGURES 5, 6) than the length of the juxtaposed hold-down extensions 17 of the elevating bail when fitted into the corresponding cleat so as to guide the back-and-forth movements of the subpanel and exposed hold-down portions of the bail relative to the cleats in the short disengaging and re-engaging movements thereof.

In its fully lowered condition the subpanel will rest near its forward and rearward ends upon a pair of spaced cross blocks 29 (FIGURE 4) standing above the bottom of the cabinet to a height sufficient to afford a clearance for the elevating bail when fully folded up beneath the panel, as well as a safe clearance for the operator's fingers in grasping the sides thereof for manipulation of the subpanel.

At the forward end of the subpanel, FIGURES 4 and 5, that is to say the end most remote from the hold-down cleats and backbox 11, there is provided a locking means in the preferred form of a lever catch 40 comprising a latching member 41, and an operating thumb piece 42 connecting therewith for reverse manipulation to move the latch member into and out of engagement with a keeper element 43 affixed to the forward pillow cross bar 29.

When the subpanel is in its fully lowered position with the exposed bail portions 17 engaged in the hold-down cleat, said latch means cooperably with the hold-down means renders the subpanel immovable, and the cabinet may be safely up-ended and handled for shipment and general usage, it being observed nevertheless that a substantial securing effect suitable for most ordinary usage is afforded by the hold-down means alone, since the heavy subpanel can have only a composite forward and upward motion in order to disengage the hold-down means, and requires application of a suitable force mainly adjacent its forward end to effect such motion.

In use the operation of the elevating means is simple, quick and safe, and requires merely release of the locking means 40, etc. (FIGURE 1) if engaged, and placement of the hands on opposite edges of the subpanel near the front end and exertion of a moderate forward and up-

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ward pulling effort sufficient to disengage the exposed portions 17 of the elevating bail from the slots 27 of the cleats, this action being accompanied by an almost concomitant rocking of the subpanel on bail 18 until stopped by the bail offset 19, and the offset ends or feet 20F of the bail about the obstructing end walls 24 of the respective shoes 21, in consequence of which the movement of the subpanel becomes governed by the radial lever action of the bail legs 20 pivoting and thrusting footing against said shoe walls 24, so that the subpanel then swings on a longer arc upwardly out of the cabinet and comes to rest substantially after the legs 20 have passed slightly over center (i.e., beyond a position vertically at right angles to the cabinet bottom) which causes the front portion of the panel to settle onto the top edge of the front cabinet wall while the rearward weight of the subpanel is supported by the bail in such over-center position (FIGURE 4) such support being safely stable to permit most repair and like operations on the equipment thus conveniently disposed.

Notwithstanding the stability of the subpanel in the withdrawn disposition aforesaid, a further safety means is provided in the form of a depending member 46, FIGURE 4, secured at the front edge of the subpanel to extend downwardly far enough to catch on the edge of the front cabinet wall in case of accidental rearward dislodgement which might send the panel on an unintended return course, it being apparent that the intentional restoration of the subpanel back into the cabinet well is achieved by a reversal of the foregoing withdrawal operation with care to see that the safety member 46 clears the front wall in so doing, it being observed that this finger tends to clear said wall more or less automatically on withdrawal because of the momentum and continuing pull which the operator usually continues to exert until he feels the panel settle onto the edge of the cabinet, as aforesaid, the slight and localized pivotal movement of the subpanel on the bight 18 of the elevating lever structure, as determined by the stopping offset 19 thereof, being sufficient to allow clearance of the safety member in both directions while the subpanel is swinging on the larger arc.

The movements of the subpanel in the elevating translation thus are initially forward toward the front wall 10F, along the axis Z—Z, FIGURES 1 and 6, and more or less simultaneously upward in a localized rocking movement about the lateral axis X—X through the bight 17 which is pivotally held by the cleats 13, this latter motion being limited by the stopping action of the offset 19, while the forward motion component is limited by abutment of the fulcrum ends or feet 20F of the radius or lever legs 20 against the stopping portions or walls 24 of the fulcrum shoes 21 approximately in the attitude depicted in FIGURE 3, which portrays substantially the condition at the end of the initial phase of the departing or withdrawing movement just before the panel begins to swing upwardly approximately along the dotted-line arc W shown in FIGURE 4, the actual arc throughout this travel depending to a minor extent upon how high the operator lifts the front end (adjacent wall 10F) at the commencement of this travel in disengaging the hold-down means 26.

In a construction according to FIGURES 1 through 6, the possibility of complete separation of the subpanel from the cabinet, as distinguished from elevation and support thereof to and upon the edge of the cabinet well or compartment, is a consequence of the detached relationship between the feet 20F of the elevating legs or lever arms 20 on the bail and the pair of guide shoes 21, the cross member or bight 18 of the lever means being pivotally attached to the subpanel, so that when the latter is to be wholly separated from the cabinet, the feet 20F simply leave the shoes and the bail goes with the subpanel.

The same advantage can be achieved by a modified

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form of the elevating mechanism such as shown in FIGURES 7 and 9 with the difference that the elevating lever means is attached to the cabinet and only impositively connected with the subpanel so that when the latter is to be wholly removed, the lever means does not follow the subpanel but remains attached to the cabinet. While satisfactory, this embodiment does not afford quite the same degree of stability against accidental dislodgement as that of FIGURE 7.

Referring to FIGURE 7 (a view analogous to that of FIGURE 6) the elevating lever bail in this modification may be substantially identical in configuration to that of FIGURE 6, and will include the bight or cross bar 18X, stopping offset 19X, and offset feet 20FX (on legs 20X), the latter, however, being pivotally affixed to the bottom of the cabinet by pivot cleats 13X, means such as a peripheral pinch 49 from the metal of the feet being provided as stops to prevent the latter from working out from beneath the cleats.

Glide brackets 50 in the form of elongated angular stampings are screwed in pairs to the underside of the subpanel shown fragmentally at 15X, one at each edge, each bracket having an elongated glide slot 51 in the depending flange portion thereof, said slots being open at one end 52 for passage of the bail bar 18X into and from the slot, and having a curved lead-in nose 54 for easy admittance of the bail bar. The condition illustrated in FIGURE 7 depicts the subpanel pulled forwardly (toward the left) almost fully from its normal position on the pillow blocks at the bottom of the cabinet, in the phase of beginning the elevating movement (or just returning to the bottom of the cabinet). As in the construction of FIGURE 4, when the subpanel is to be elevated, it is pulled forward (toward the right, FIGURE 9) until the closed end 53 of the long slot is engaged by the bail bar 18X, and the latter can enter locking notch 55, thus transferring some of the effort to the lever legs 20X and converting the movement into the pivotally-swinging translation which will carry the panel upwardly in the manner depicted in dotted lines in FIGURE 9.

It will be observed that the long slots in the glide cleats 50 are provided at their closed ends with upwardly offset rod-seating notches 55 into which the crosswise bight portions 17X of the U-shaped lever bail fit and seat for added stability both during the pivotal translation of the panel and after the latter comes to rest in its fully elevated condition.

Should it be required to separate the subpanel entirely from the game cabinet after it has been elevated, as aforesaid, and rests, after the manner of FIGURES 2 and 4, upon the cabinet wall, the subpanel 15X may be grasped in its rearward region close to the cleats 50 and lifted slightly so that the bail 18X can leave the notches 55 easily and the panel may then be worked rearwardly until the bail leaves the cleat at the open ends 52, whereupon the panel is wholly free and may be lifted away, the elevating lever means in this embodiment, however, remaining attached to the cabinet rather than to the subpanel.

Some of the advantages of the described embodiments of the subpanel elevating means thus far described may be realized in an economical but commercially less desirable modification, such as shown in FIGURES 8 and 10, wherein two open-ended glide brackets 50, identical to those previously described and employed in like manner, are attached in pairs, one at each side of the subpanel 15Z and in approximately the same relative positions depicted in FIGURES 7 and 9. But in place of the formed U-shaped lever means 18X, 19X, 20X, 20FX, etc., a solid elevator panel 60 of wood or like rigid material is used as the lever and load supporting means, said panel being provided with a pair of pivot cleats 61 affixed on opposite sides thereof and each having a lateral pivot stud 62 projecting sidewise to engage in a corresponding one of the long glide slots 51.

As viewed in FIGURE 10, the lower or front end of the lever panel, that is to say, the lateral margin 60A thereof which is most remote from the pivot cleats 61, terminates a substantial distance short of the adjacent panel-supporting pillow block 29A, thus affording a clearance permitting the subpanel 15Z to be pulled forward from its normal position of rest on said pillow blocks, as in the case of the previously described embodiment, until the said lower or abutment edge 60A of the lever panel abuts the forward pillow block 29A affording a fulcrum stopping such shifting and converting the motion into the required upward translation occurring partially about a fulcrum axis (at the point FX, FIGURE 10) which is at the abutment conjunction of the foot or lower margin 60A of the panel and the forward pillow block 29A, and partially about the pivotal axis through the pivot studs 62, the elevating action from this point onward being substantially the same as that involved in the previously described embodiments with the lever panel 60 reaching a vertically-disposed stable condition slightly beyond center to support the rearward portions of the subpanel substantially as in the case of the lever bail 18, 20 of FIGURES 2 and 4.

Each of the described embodiments in its elevating translation of the subpanel permits of a more or less linear shifting motion of the subpanel in the initial and terminal phases of its travel, two purposes being served by such motion, the first of which is the fact that when a heavily burdened subpanel is to be raised, momentum developed in the initial shifting toward the front of the cabinet aids in making the transition from mostly linear motion to pivotal motion, first about the axis through the bight or cross bar portions 17, 18 of the bail type lever limited by the offset stopping formation 19, 19X (or bevel 64 in the panel lever type), and subsequently about the abutment axis established when the feet 20F engage the walls 24 of the shoes, or the equivalent axis through the captive cleated foot portions 20FX when the bail bar is stopped and engages in the end notches 55.

The second purpose is illustrated best in FIGURE 9 wherein the top playfield panel 14 is shown held in raised position by a prop rod 14A, this panel turning upon hinges 16 affixed to the cabinet side-walls, it being observed that the rearward portions 14R of the playfield panel lie close beneath the bottom of the backbox 11 and closely overlie elements E forming part of the equipment carried by the subpanel, in such relationship that if the subpanel were to be raised directly in attempt to pull it out of the compartment, there would very likely be collision between the rearward parts and equipment on the subpanel and overlying parts of the playfield panel at 14R with the possibility of serious equipment damage. Accordingly, the elevating means allows for various equipment arrangements and contingencies by permitting a forward shift of the subpanel out of the collision zone before the upward swing begins, it being necessary to shift the subpanel forward in each of the embodiments before such upward translation can begin, so that the elevating means is self-guarding in these respects, apart from the added advantage from the momentum imparted to the weighty mass which aids in starting the pivotal elevating motion.

The described embodiments are each effective to facilitate an end foremost elevation of the subpanel from the cabinet, the forms of FIGURES 3 and 8 having the advantage that the lever bails do not obstruct the view beneath the elevated panel, whereas the solid lever means of FIGURES 9 and 10 does tend to obscure such a view.

We claim:

1. Elevating means for moving a panel upwardly and out through the top opening of a cabinet compartment, said means comprising: an elevating lever having pivotal attachment to said panel to pivot about a first axis transverse to a second axis of exit and reentry of the panel,

the latter having a linear freedom of movement along the second axis when seated within the cabinet, said lever including long radius leg means extending in the direction of said second axis at right angles to said first axis toward a particular end of the panel which will rise toward and thereafter emerge through said opening responsive to manual withdrawal effort applied to the panel in the region adjoining said particular end thereof; said leg means having a free end thrust portion disposed away from the first axis toward said particular end to engage a fulcrum and to serve as a radius leg for swinging the panel on an exit or reentry arc having substantially the radius of said leg means; fulcrum means fixed in position in said compartment in a position of alignment with said free end portion of the leg means and spaced in a direction along said second axis therefrom in a direction away from said first axis and toward said panel end a short distance such that an initial withdrawal effort applied to the panel as aforesaid with a linear component pulling the panel in the direction of the second axis will engage said free end portion of the leg means with said fulcrum means for stoppage by the latter in a manner such that continuation of said withdrawal effort generally thereafter in said last direction will cause the radius leg of said elevating lever to pivot at said fulcrum means with said panel swinging on the arc thereof upwardly and outwardly of the top opening as aforesaid, the length of the radius of said leg means of the elevating lever in relation to the depth of said compartment being such that said panel is in a substantially horizontal attitude at the top of said arc, and continuing outward limited motion thereof is permitted sufficient to carry said radius leg of the elevating lever past a vertical central position sufficiently to cause the region of the panel adjacent said particular end thereof to settle down upon a marginal portion of the top opening at a point spaced from the elevating lever in said position, whereby to support the panel in a stable position of access outside of said compartment cooperatively with said leg means.

2. Apparatus according to claim 1 wherein there is provided means for limiting the pivotal movement of said elevating lever means relative to the panel to a small angular displacement about said first axis to permit a limited upward lifting of the panel at said end thereof as a component of said initial withdrawal effort whereby said particular end of the panel tends to be started on an upward course substantially concomitantly with movement thereof along the second axis which causes engagement between the free end portion of the radius leg and said fulcrum means.

3. Apparatus according to claim 1 wherein said fulcrum means comprises a member having oppositely spaced side margins extending in approximate parallelism with said second axis and defining a guide path therebetween in which said free end portion of the radius leg is received and guided in initial advance as aforesaid, together with a stopping formation at the end of said guide path engaged by said free end portion and determining the pivoting fulcrum as aforesaid.

4. Apparatus according to claim 1 wherein said elevating lever means has a hold-down portion exposed at a side of said panel, and there is additionally provided in said compartment in fixed juxtaposition therewith a hold-down fixture having a hold-down formation engageable and disengageable by said hold-down portion of the lever means responsive to oppositely-directed withdrawal and return motion of the panel along said second axis such that when the panel is mover a predetermined amount along said second axis away from said fulcrum means and toward said fixture the hold-down portion engages with said hold-down formation to prevent upward displacement, at least, of the appurtenant region of the panel, and reverse motion of the panel a predetermined short distance in the opposite direction away from said fixture will

effect disengagement from the latter to free the panel for upward motion from the compartment as aforesaid.

5. Apparatus according to claim 4 further characterized by the provision of a manually-set latching means adjacent said particular end of the panel for securing the latter end immovably in the compartment in that condition of the panel wherein said hold-down means is effective to prevent displacement of the appurtenant region of the panel as aforesaid, whereby the panel is rendered immovable.

6. Subpanel elevating means comprising, in combination with a cabinet having a bottom with upstanding side-walls and a top opening; a subpanel adapted to rest at the bottom within the cabinet and having a forward margin and a rearward margin respectively disposed in adjacency to front and rear walls of the cabinet; means for assisting the manual elevation of said subpanel by directing its forward margin foremost along a path becoming upwardly arcuate in the general direction of the appertaining front wall of the cabinet and outwardly therefrom over and onto the top of said front wall through said opening; said elevating means including the provision of fixed fulcrum means located in the bottom region of the cabinet adjacent said front wall, together with elevating lever means and further means pivotally interconnecting the same with said subpanel at a point remote from said front margin toward said rear margin thereof, said lever means having a foot portion adapted to pivot relative to said fulcrum means in elevating the subpanel; said lever means, fulcrum means and further interconnecting means being arranged and constructed for operation such that the subpanel is permitted a limited range of substantially linear as distinguished from angular back and forth movement along a fore and aft axis between said front and rear cabinet walls with permissive concurrent pivotal motion between the lever means and subpanel, such that movement a predetermined distance from a predetermined position of rest of the subpanel in said bottom region of the cabinet toward the front wall thereof, by application of a combination pulling and lifting manual effort in the region of the forward margin of the subpanel, will effect elevation of the subpanel along the upwardly arcuate path aforesaid out of the cabinet with a forward portion thereof resting upon the top of said front wall, and a rearward portion thereof stably supported by said lever means standing in a position approximately at right angles to the panel and the bottom of the cabinet.

7. The combination set forth in claim 6 wherein there is further provided a limiting means cooperable with the elevating lever means and permitting the subpanel and lever means to pivot one with respect to the other an amount sufficient to permit the lever means to reach and pass slightly beyond the right angle condition set forth whereby to further stabilize the support of the rearward region of the subpanel against accidental collapsing dislodgment reversely back into the cabinet.

8. Apparatus according to claim 6 wherein said further interconnecting means affords a separate interconnection between the lever means and subpanel, whereby the latter may be wholly disengaged therefrom in the elevated condition thereof and wholly separated from the cabinet.

9. A construction according to claim 6 wherein said elevating lever means comprises two parallel lever legs, one at each of the opposite side margins of said subpanel, together with means pivotally interconnecting the same with the subpanel, each said leg having a foot portion aligned with said fulcrum means and glidingly engageable and disengageable therewith responsive to said back and forth movement.

10. The construction set forth in claim 9 wherein said legs are joined by a lateral portion extending crosswise of the subpanel in close proximity therewith and cooperable in said pivotal interconnection therewith, and each said leg has a foot formation at an end thereof distant

from said interconnection toward said front wall for engagement with said fulcrum means.

11. The construction set forth in claim 10 wherein said fulcrum means comprises guiding means aligned with each said foot formation and serving to constrain the back and forth movement thereof, responsive to like movement of the subpanel, to a predetermined fore and aft glide path, said guiding means providing a terminal obstruction to such gliding movement in the forward direction toward the front wall of the cabinet and defining the fulcrum point for elevating arcuate travel of the subpanel.

12. A construction according to claim 6 wherein there is additionally provided a hold-down means situated for engagement with said lever means in a rearward terminal position of the latter responsive to movement of the subpanel aft to said position of rest thereof.

13. A construction according to claim 6 wherein said pivotal interconnecting means comprises bracket means attached to opposite sides of the subpanel and respectively having elongated slot means aligned with the direction of said back and forth axis, said lever means having portions pivotable in, and slidable back and forth in said slot means, and said foot portion of the lever means is fixed in pivotal engagement with said fulcrum means.

14. Subpanel elevating means according to claim 6 wherein said elevating lever means comprises a rigid lever panel having a bottom margin constituting the foot portion engageable with the fulcrum means as aforesaid, and an opposite top portion engaging with said further means pivotally interconnecting the lever means with the subpanel, as aforesaid.

15. Apparatus as set forth in claim 14 further characterized in that said further pivotal interconnecting means comprises a pintle member fixed at each side of said rigid lever panel adjacent said top portion thereof and in alignment with a pivot axial transverse to said fore and aft axis, and said further interconnecting means comprises a pair of brackets respectively fixed on opposite sides of the subpanel in juxtaposition with said pintle members, said brackets each having an elongated slot extending parallel with said fore and aft axis and in each of which one of said pintle members is pivotally and slidably received to permit the back and forth and pivotal movements of the subpanel and lever means as aforesaid, said slots being open at their ends proximate to the front wall of the cabinet whereby the subpanel may be wholly separated from the lever means when in elevated condition from within the cabinet as aforesaid.

16. Apparatus according to claim 14 wherein there is further provided means for limiting relative pivotal motion between the subpanel and lever panel to stop the latter in a stable past-center position slightly beyond a right-angle relationship between the subpanel and cabinet bottom at the fulcrum point when the subpanel is elevated, whereby to reduce danger of accidental dislodgment of the subpanel starting it reversely back into the cabinet.

17. An elevating and reentry leverage structure for use with a first object, such as a panel, which is movable to be manually lowered into, or elevated outwardly of a second object which is relatively stationary, such as a cabinet compartment, wherein the leverage structure comprises a single lever means having radially opposite sides one of which is captured on a first one of said objects by means permitting only pivotal movement thereof, and the other of which sides is relatively free to shift into and from engagement with an abutment pivot means fixed on the second one of said objects responsive to limited and substantially linear displacement of the movable one of said objects from a lowered condition of rest with respect to the stationary object in a predetermined direction at right angles to the axis of the pivotal movement aforesaid, the range of pivotal movement of said lever means at the free side thereof with respect to said abutment means being

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substantially greater than 90° such that the movable object can be manually displaced from said condition of rest by a compound motion which is initially linear as aforesaid and translates into angular movement elevating the movable object from the position of rest to a zenith position above the level of said fulcrum means and slightly past center therebeyond wherein the movable object continues to settle upon a marginal portion of the stationary object, by which it is then supported in elevated condition cooperatively with the lever means in said past center position, with reverse action of the lever means and movable object in lowering back to said condition of rest.

18. A lever system aiding elevation and lowering movement of an apparatus panel member or like burden, in a given direction between elevated and normally lowered stable positions of rest with respect to an upper support means and a lower bed member, said system comprising, in cooperative combination with said support means and said panel and bed member: abutment fulcrum means; elevating lever means having opposite radial end portions one of which constitutes a first and relatively fixed pivot point therefor, and the other of which constitutes a relatively detached free end thrust portion to be translated in a substantially linear sense to and from engagement with said fulcrum means to establish a second pivot for the lever means responsive to initial elevating effort moving the panel member generally in said given direction and including a linear component sufficient to engage said thrust portion with the fulcrum means as aforesaid; means

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attaching said first pivot point portion of the lever means to one of said panel and bed members for pivotal motion about a first axis substantially transverse to said given direction; said fulcrum means being positioned on the other one of said members in alignment with and spaced generally in said given direction from said thrust portion of the lever in the normal rest position of the panel member for engagement by the thrust portion translated as aforesaid whereby to establish said second pivot point as a function of such initial movement of the panel member, and conversely to disengage the fulcrum means on reverse lowering movement of the panel member to said normal rest position, establishment of the second pivot point in the manner aforesaid affording support to the panel burden to pivotally swing the same by continued elevating effort upward into the said elevated condition of rest stably supported partly on said upper support means and partly by said lever means.

References Cited

UNITED STATES PATENTS

1,437,063	11/1922	Lundeen	312—28
2,082,672	6/1937	Waugh	312—325
2,100,247	11/1937	Groues	312—282
2,607,651	8/1952	Preuss	312—30

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